

## Improving Process Water Efficiency: How to Implement Industrial Water Reuse

### A Systematic Approach & Case Study



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## Today's Water Environment



- ◆ Water availability and wastewater disposal options are becoming increasingly more restrictive
- ◆ Increased Emphasis on Sustainability
- ◆ Water reuse has become a preferred option for some facilities
  - Other sources of water are not available
  - Regulations make permitting new sources difficult
  - Costs for (process) water production and wastewater disposal exceed the cost (and reliability) of reusing treated wastewater



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## Drivers: Why Reuse/Conserve Water?



- Limited Availability of Water
- Raw Cost
- Ancillary Costs (chemicals, energy, etc.)
- Water Source Reliability
- Regulations/Executive Orders (13123)
- Environmental Stewardship/Public Image



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## Integrated Systematic Approach

- ◆ Water streams of differing quality
- ◆ Water management strategies,
- ◆ Treatment technologies
- ◆ Systems thinking across departments and processes
- ◆ Systematic approach

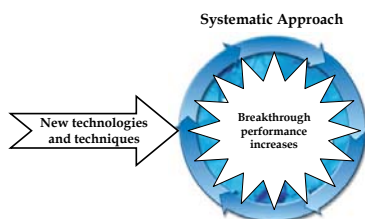


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## The Power of Systems Thinking

- Thinking across departments and processes
- Understanding economic, technological, and environmental drivers
- Modeling an entire plant (or even neighboring plants)
- Understanding the interdependencies



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## Benefits of Water Reuse



- ◆ Materials Recovery
- ◆ Reduced Energy Consumption.
- ◆ More Siting Options.
- ◆ Elimination of Discharge Permit.
- ◆ Reduction in Process Water Treatment Needed.
- ◆ Financial Incentives.
- ◆ Enhanced Public Image.

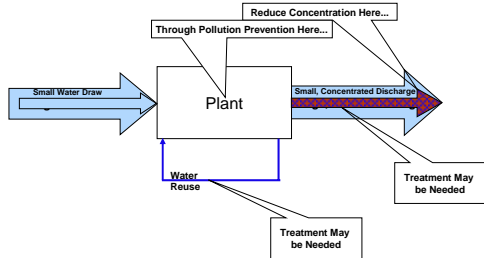


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## Water Reuse Can Help...but:

- ◆ There are Upsides and Downsides



## The Systematic Approach



## Six-Step Approach to Water Reuse

- Step 1: Establish leadership and commitment for the effort.
- Step 2: Frame the problem and set boundary limits for the study.
- Step 3: Evaluate technical opportunities and water reuse techniques, develop alternatives, and define potential problems and contingencies.
- Step 4: Select a course of action.
- Step 5: Implement the new course of action.
- Step 6: Review and update the model or design as needed.



## Aerospace Manufacturer

- ◆ Aerospace Manufacturer implements water reuse and:
  - Lowers purchased water consumption
  - Reduces wastewater discharges
  - May result in less stringent discharge concentration limits.
  - Results in annual operating cost savings.
  - Demonstrates environmental stewardship.

## Facility Description



- ◆ AFP 6 - government-owned, contractor-operated facility.
- ◆ Constructed in 1943, located in Marietta, Georgia, operated by LM Aero.
- ◆ Military aircraft, (C-5 and C-130 transports, F-22 fighter) manufactured and/or refurbished at AFP 6.



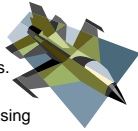
## Facility Description



- ◆ Manufacturing operations divided into six major areas:
  - Machining and grinding
  - Solvent degreasing
  - Metal finishing (cleaning, electroplating, anodizing, conversion coating)
  - Spray painting
  - Aircraft assembly
  - Utilities including Steam plant (16 boilers), Cooling towers (131), Wastewater treatment plant

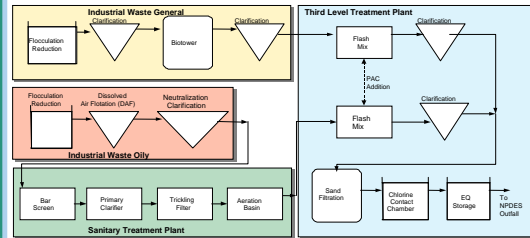
## Step 1: Establish Leadership and Commitment (Motivation)

- ◆ Effluent Receiving Water Limitations.
- ◆ Low Discharge Limits, Especially for Metals.
- ◆ Reissue of NPDES Permit
- ◆ Compliance Issues Associated With Increasing Production.
- ◆ Reduce Amount of Purchased Water (\$\$)
- ◆ Increase Available Withdrawal Amounts for Downstream Users - Important for Interstate Water Compact Negotiations.
- ◆ Environmental Stewardship

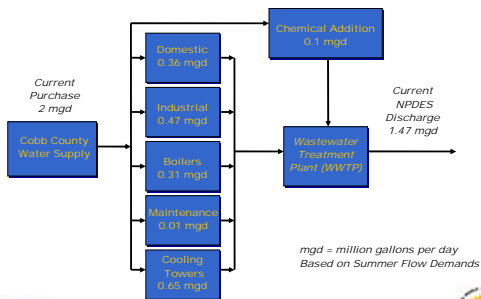


## Step 2: Frame the Problem

### ◆ Plant Overview



## Data and Water Balance



## Step 3: Develop Alternatives

- ◆ Objectives:
  - Supply for reuse 240-720 gpm water of drinking water quality,
  - Up to 55 gpm water with low TDS and oil & grease, and
  - Up to 90 gpm water with low alkalinity, hardness, silica, iron, copper, and 7<pH<8.5.



## Constraints and Evaluation

- ◆ Minimize installation costs for water reuse.
- ◆ Use surplus ultrafiltration (UF) and RO equipment found at AFB 44.
  - Modifications required due to differences in water source and changes in membrane technology.
- ◆ Original concept envisioned supplying two different waters to end-users (high and low quality effluent)
  - Would require two separate distribution systems
  - Decided to supply all end-users with RO treated water.

## Step 4: Select a Course of Action

- ◆ Identify end-users.
- ◆ Conceptually configure equipment.
- ◆ Pilot-test UF and RO using LM aero's wastewater.
- ◆ Evaluate RO concentrate disposal
- ◆ Design UF/RO System
- ◆ Design conveyance systems
- ◆ Construct RO and conveyance systems



- ◆ **LM Aero System Design**



### Step 6: Review and Update